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REVIEW ARTICLE

Vertical supranuclear gaze palsy in Niemann-Pick type C disease

Ettore Salsano · Chizoba Umeh · Alessandra Rufa · Davide Pareyson · David S. Zee

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Abstract Vertical supranuclear gaze palsy (VSGP) is a key clinical feature in patients with Niemann-Pick type C disease (NP-C), a rare, autosomal recessive, neuro-visceral disorder caused by mutations in either the *NPC1* or *NPC2* gene. VSGP is present in approximately 65 % of the cases and is, with gelastic cataplexy, an important risk indicator for NP-C. VSGP in NP-C is characterized by a paralysis of vertical saccades, especially downward, with the slow vertical eye movement systems (smooth pursuit and the vestibulo-ocular reflex) spared in the early phase of the disease. This dissociation is caused by a selective vulnerability of the neurons in the rostral interstitial nuclei of the medial longitudinal fasciculus (riMLF) in NP-C. Here we discuss VSGP in NP-C and how clinicians can best elicit this sign.

Keywords Niemann-Pick type C disease · Vertical eye movements · Vertical ocular motor apraxia · Vertical supranuclear gaze palsy

Abbreviations

III	Third cranial nerve
IV	Fourth cranial nerve (trochlear nerve)
FEF	Frontal eye fields
MLF	Medial longitudinal fascicle
DLPN	Dorsolateral pontine nucleus
DV	Dorsal vermis
IO	Inferior oblique
IR	Inferior rectus
MT	Middle temporal area
MST	Medial superior temporal area
NP-C	Niemann-Pick type C
NRTP	Nucleus reticularis tegmenti pontis
OKN	Optokinetic nystagmus
PEF	Parietal eye fields
PPRF	Paramedian pontine reticular formation
riMLF	Rostral interstitial nuclei of the medial longitudinal fasciculus
SC	Superior colliculi
SCC	Semicircular canals
SO	Superior oblique
SPEM	Smooth pursuit eye movements
SR	Superior rectus
VN	Vestibular nuclei
VOR	Vestibulo-ocular reflex
VPF	Ventral paraflocculus
VSGP	Vertical supranuclear gaze palsy

E. Salsano (✉) · D. Pareyson
Department of Clinical Neurosciences, Fondazione IRCCS Istituto Neurologico Carlo Besta, via Celoria 11, 20133 Milano, Italy
e-mail: ettore.salsano@istituto-besta.it

C. Umeh · D. S. Zee
Department of Neurology, The Johns Hopkins University School of Medicine, Baltimore, MD, USA

A. Rufa
Department of Neurological, Neurosurgical and Behavioural Sciences, University of Siena, Siena, Italy

Introduction

Niemann-Pick type C disease (NP-C) is a rare, fatal, autosomal recessive, neuro-visceral disease, caused by loss-of-function mutations in either the *NPC1* (~95 %) or *NPC2* (~5 %) gene. The consequence of *NPC1* or *NPC2* mutations is the inhibition of the egress of unesterified cholesterol and other lipids from late endosomes and lysosomes. These lipids accumulate at these sites and are